WHAT IS CLAIMED IS:

1. A nucleic acid sequence amplification method using polymerase chain reaction (PCR), which method comprises:

a step of injecting into a reaction vessel a sample containing a template DNA having target nucleic acid sequences to be amplified, DNA polymerase, deoxyadenosine triphosphate, deoxycytidine triphosphate, deoxyguanosine triphosphate, deoxythymidine triphosphate, and at least two oligonucleotide primers complementary to the 3' terminus of each of the target nucleic acid sequences; and

a step of maintaining a specific spatial temperature distribution in the sample by contacting thermally with the sample a plurality of heat sources which supply heat to, or remove heat from specific regions of the sample such that a relatively high temperature region is located lower in height than a relatively low temperature region,

wherein the specific spatial temperature distribution comprises specific spatial regions each fulfilling a temperature condition suitable for (i) a denaturation step in which double stranded DNAs become separated to single stranded DNAs, (ii) an annealing step in which the single stranded DNAs formed in the denaturation step hybridize to the primers to form DNA-primer complexes, or (iii) a polymerization step in which the primers in the DNA-primer complexes are extended by the polymerization reaction,

and wherein the specific spatial temperature distribution is a temperature distribution that induces circulation of the sample by thermal convection so that the denaturation, annealing, and polymerization steps occur sequentially and repeatedly inside the sample.

2. The nucleic acid sequence amplification method of claim 1, wherein at least one of the heat sources comprises a thermally conductive solid in thermal contact with a specific region of the reaction vessel or the sample; and a heating unit that supplies heat to the thermally conductive solid, a cooling unit that removes heat from the thermally conductive solid, or a combination of the heating unit and the cooling unit.

3. The nucleic acid sequence amplification method of claim 1, wherein at least one of the heat sources comprises a liquid in thermal contact with a specific region of the reaction vessel; a receptor

in which the liquid is to be contained; and a heating unit that supplies heat to the liquid, a cooling unit that removes heat from the liquid, or a combination of the heating unit and the cooling unit.

4. The nucleic acid sequence amplification method of claim 3, wherein at least one of the heat sources further comprises a circulation unit that circulates the liquid around the reaction vessel.

5. The nucleic acid sequence amplification method of claim 1, wherein at least one of the heat sources comprises a gas in thermal contact with a specific region of the reaction vessel; a heating unit that supplies heat to the gas, a cooling unit that removes heat from the gas, or a combination of the heating unit and the cooling unit; and a circulation unit that circulates the gas around the reaction vessel.

6. The nucleic acid sequence amplification method of claim 1, wherein at least one of the heat sources is an infrared radiation generating unit that supplies heat directly to the sample.

7. The nucleic acid sequence amplification method of claim 1, which method uses a means for insulating heat transfer between the heating sources.

8. A nucleic acid sequence amplification apparatus using PCR, which apparatus comprises:

a plurality of heat sources which may supply heat to, or remove heat from a plurality of specific regions in a sample contained in a reaction vessel,

wherein the heat sources are arranged to maintain a specific spatial temperature distribution in the sample such that a relatively high temperature region is located lower in height than a relatively low temperature region,

wherein the specific spatial temperature distribution comprises specific spatial regions each fulfilling a temperature condition suitable for (i) a denaturation step in which double strand DNAs become separated to single strand DNAs, (ii) an annealing step in which the single strand DNAs formed in the denaturation step hybridize to the primers to form DNA-primer complexes, or (iii) a polymerization step in which the primers in the DNA-primer complexes are extended by the polymerization reaction,

and wherein the specific spatial temperature distribution is a temperature distribution that

induces circulation of the sample by thermal convection so that the denaturation, annealing, and polymerization steps occur sequentially and repeatedly inside the sample.

9. The nucleic acid sequence amplification apparatus of claim 8, wherein at least one of the heat sources comprises a thermally conductive solid in thermal contact with a specific region of the reaction vessel or the sample; and a heating unit that supplies heat to the thermally conductive solid, a cooling unit that removes heat from the thermally conductive solid, or a combination of the heating unit and the cooling unit.

10. The nucleic acid sequence amplification apparatus of claim 8, wherein at least one of the heat source comprises a liquid in thermal contact with a specific region of the reaction vessel; a receptor in which the liquid is to be contained; and a heating unit that supplies heat to the liquid, a cooling unit that removes heat from the liquid, or a combination of the heating unit and the cooling unit.

11. The nucleic acid sequence amplification apparatus of claim 10, wherein at least one of the heat sources further comprises a circulation unit that circulates the liquid around the reaction vessel.

12. The nucleic acid sequence amplification apparatus of claim 8, wherein at least one of the heat sources comprises a gas in thermal contact with a specific region of the reaction vessel; a heating unit that supplies heat to the gas, a cooling unit that removes heat from the gas, or a combination of the heating unit and the cooling unit; and a circulation unit that circulates the gas around the reaction vessel.

13. The nucleic acid sequence amplification apparatus of claim 8, wherein at least one of the heat sources is an infrared radiation generating unit that supplies heat directly to the sample.

14. The nucleic acid sequence amplification apparatus of claim 8, which method uses a means for insulating heat transfer between the heating sources.

15. The method according to claim 1, wherein the heat source is shaped to comprise at least one protrusion that fits in an opening of the reaction vessel, wherein said protrusion contacts the sample.

16. The apparatus according to claim 8, wherein the heat source is shaped to comprise at least one protrusion that fits in an opening of the reaction vessel, wherein said protrusion contacts the sample.